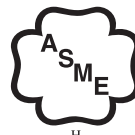


Slant/Fin[®]

SENTINEL[™]



HOT WATER MODELS SE-70 THROUGH SE-245

GAS-FIRED CAST-IRON BOILERS FOR NATURAL AND L.P. PROPANE GASES

INSTALLATION AND OPERATING INSTRUCTIONS

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IMPORTANT

**READ ALL OF THE FOLLOWING
WARNINGS AND STATEMENTS
BEFORE READING THE
INSTALLATION INSTRUCTIONS**

WARNING

SEE "WARNING" ON PAGE 4
FOR LIQUEFIED PETROLEUM (L.P.)
PROPANE GAS-FIRED BOILERS

The installation must conform to the requirements of the authority having jurisdiction or, in the absence of such requirements, to the National Fuel Gas Code, ANSI Z223.1 latest edition or CSA B 149.1 latest edition for natural gas and propane. The installation must also conform to the additional requirements in this Slant/Fin Instruction Book.

In addition, where required by the authority having jurisdiction, the installation must conform to American Society of Mechanical Engineers Safety Code for Controls and Safety Devices for Automatically Fired Boilers, No. CSD-1 or CSA B 149.1 latest edition for natural gas and propane. If there is any conflict in the above requirements, then the more stringent requirement will apply.

WARNING

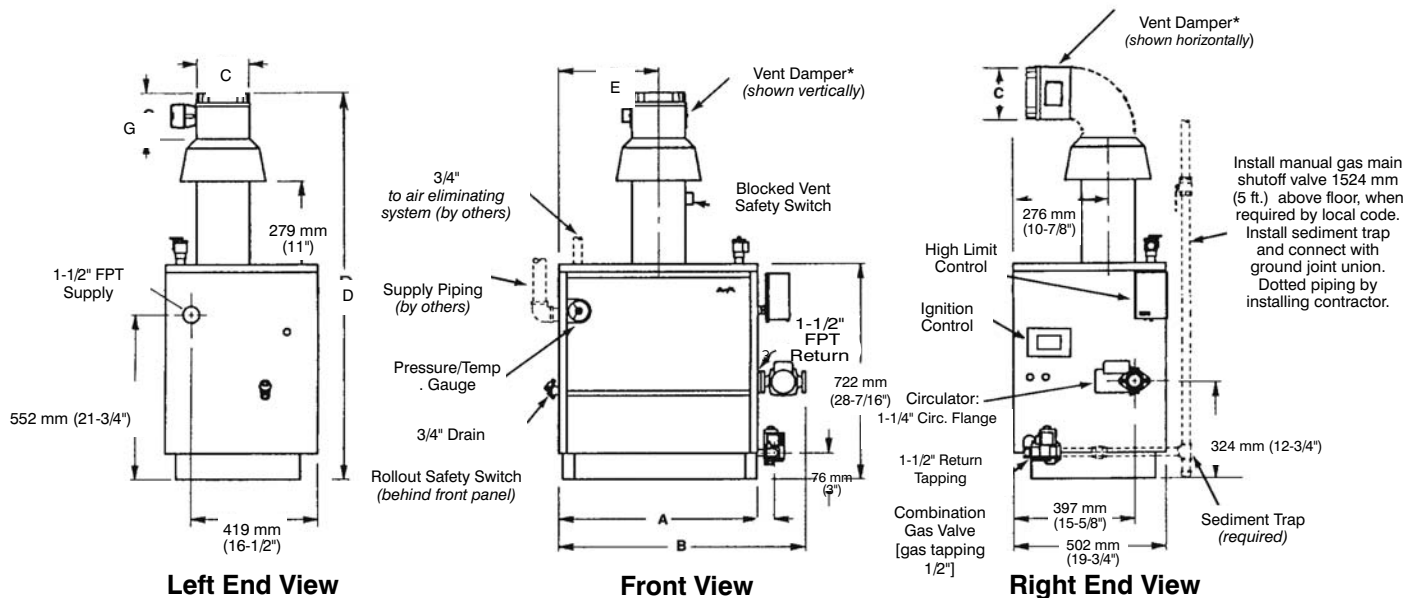
This boiler, gas piping and accessories must be installed, connected, serviced and repaired by a trained, experienced service technician, familiar with all precautions required for gas-fired equipment and licensed or otherwise qualified, in compliance with the authority having jurisdiction.

This manual must be left with owner and should be hung on or adjacent to the boiler for reference.

| | |
|--------------------|----------------------|
| Heating Contractor | Boiler Model Number |
| Address | Boiler Serial Number |
| Phone Number | Installation Date |

Dimensions

MODEL SE-70 to SE-245



Note: Height dimension increases by 44 mm (1 3/4") when combustible floor kit is used.

* Vent damper may be installed horizontally on all models with use of a vent elbow. For more information, see Figure 2, page 5.

CHIMNEY RECOMMENDATIONS

HEIGHT: 4.6 m (15 ft.) (minimum) from draft hood skirt to top of chimney.

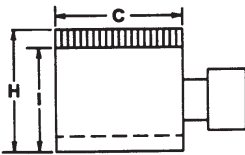
INSIDE DIAMETER: Same as dimension C (or larger).

NOTE: Larger chimney may be required if two or more boilers or a boiler and another appliance are vented to a single chimney.

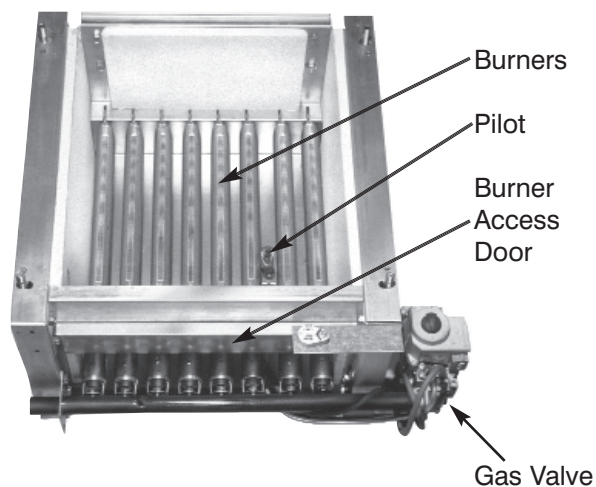
| Boiler Model | No. of Sect. | Dimensions | | | | | | | | | | Approx. Total Wt. Full of Water | | | |
|--------------|--------------|------------|--------------------------------|-----|--------------------------------|-----|-----|------|---------------------------------|-----|--------------------------------|---------------------------------|--------------------------------|-----|-----|
| | | A | | B | | C | | D | | E | | G | | | |
| | | mm | in. | mm | in. | mm | in. | mm | in. | mm | in. | mm | in. | | |
| SE 70 | 3 | 283 | 11 ¹ / ₈ | 448 | 17 ⁵ / ₈ | 102 | 4 | 1289 | 50 ³ / ₄ | 143 | 5 ⁵ / ₈ | 152 | 6 | 113 | 250 |
| SE 105 | 4 | 359 | 14 ¹ / ₈ | 524 | 20 ⁵ / ₈ | 127 | 5 | 1311 | 51 ⁵ / ₈ | 181 | 7 ¹ / ₈ | 152 | 6 | 141 | 310 |
| SE 140 | 5 | 435 | 17 ¹ / ₈ | 600 | 23 ⁵ / ₈ | 127 | 5 | 1311 | 51 ⁵ / ₈ | 219 | 8 ⁵ / ₈ | 152 | 6 | 166 | 365 |
| SE 175 | 6 | 511 | 20 ¹ / ₈ | 676 | 26 ⁵ / ₈ | 152 | 6 | 1356 | 53 ³ / ₈ | 257 | 10 ¹ / ₈ | 165 | 6 ¹ / ₂ | 193 | 425 |
| SE 210 | 7 | 587 | 23 ¹ / ₈ | 752 | 29 ⁵ / ₈ | 178 | 7 | 1376 | 54 ³ / ₁₆ | 295 | 11 ⁵ / ₈ | 179 | 7 ¹ / ₁₆ | 220 | 485 |
| SE 245 | 8 | 664 | 26 ¹ / ₈ | 829 | 32 ⁵ / ₈ | 178 | 7 | 1376 | 54 ³ / ₁₆ | 333 | 13 ¹ / ₈ | 179 | 7 ¹ / ₁₆ | 247 | 545 |

| Gas Type | Orifice Size for Sea Level | Orifice Sizes for High Altitudes Reduce output 10% | |
|----------|----------------------------|---|----------------------------------|
| | | Elevation – Meters (Feet) | |
| | | 610m – 1220m (2000' – 4000') | 1220m – 1372m (4000' – 4500') |
| Natural | 47 | 48 | 49 |
| Propane | 56 | 56 | 57 |

Orifice indicated for sea level above are factory installed in boiler unless otherwise specified by the local authority. See Section "III" on page 15 for burner input adjustment.

|  | | | |
|---|---------------|--------------------|---------------------|
| Field Control (Effikal) Vent Damper | | | |
| Model | C | H | I |
| SE-70 | 102mm (4") | 152mm (6") | 122mm (4-13/16") |
| SE-105 | 127mm (5") | 152mm (6") | 122mm (4-13/16") |
| SE-140 | 152mm (6") | 165mm (6-1/2") | 135mm (5-5/16") |
| SE-175 | 178mm (7") | 179mm (7-1/16") | 149mm (5-7/8") |
| SE-210 | 178mm (7") | 179mm (7-1/16") | 149mm (5-7/8") |
| SE-245 | 178mm (7") | 179mm (7-1/16") | 149mm (5-7/8") |

Base Assembly
Sentinel Boiler



INSTALLATION REQUIREMENTS

IMPORTANT: This equipment must be installed in accordance with the requirements of CSA B 149.1 latest edition for natural gas propane. Installation Codes for Gas Burning Appliances must conform to requirements of the local gas company, local building codes, and other authorities which have jurisdiction. Such requirements, where applicable, take precedence over these general instructions. All electrical connections must be in accordance with Canadian Electrical Code C22.1 Part 1.

This installation must also conform to the additional requirements in this Slant/Fin Instruction Book.

NATURAL GAS-FIRED BOILER LOCATION

Provide a level, solid foundation for the boiler. Location should be as near as possible to chimney or outside wall so that the flue pipe from boiler is short and direct.

The location should also be such that the gas ignition system components are protected from water (dripping, spraying, rain, etc.) during appliance operation and service (circulator replacement, condensate trap, control replacement, etc.).

BOILER FOUNDATION

- Provide a solid, level foundation, capable of supporting the weight of the boiler filled with water, and extending at least 51 mm (2") past the jacket on all sides. See dimensions of boiler, page 2.
- For installation on non-combustible floors only. The Combustible Floor Kit part number printed on the boiler rating plate is the only one to be used when installing on combustible floors. The boiler must not be installed on carpeting.
- If boiler is to be located over buried conduit containing electric wires or telephone cables, consult local codes or the National Board of Fire Underwriters for specific requirements.

WARNING
SPECIAL ATTENTION FOR LIQUEFIED
PETROLEUM (L.P.)
PROPANE GAS-FIRED BOILER INSTALLATIONS

LPG appliances (boilers) shall be installed in accordance with applicable provisions of NFPA 58 (Liquefied Petroleum Gas Code) latest edition for installations in US and CAN/CGA B149.1 latest edition for installations in Canada

Liquefied Petroleum (LP) propane gas is heavier than air therefore Propane gas can accumulate at floor level. If you suspect a leak, do not attempt to operate boiler. A spark or flame from the appliance (boiler) or other sources may ignite the accumulated propane gas causing an explosion or fire. It is recommended that inspections for gas leaks be performed periodically by a licensed professional and that leak detection devices be installed as a further safety measure.

CHIMNEY REQUIREMENTS

A. Sentinel boilers may be vented into a masonry vitreous tile-lined chimney or type "B" venting system NOT EXPOSED to the OUTDOORS below the roof line.

Venting and sizing of venting system must be in accordance with the requirements of the local gas utility, local building codes and other authorities having jurisdiction.

If a masonry chimney is exposed to the outdoors on one or more sides below the roof line (exterior chimney), ONE of the following options apply:

1. Chimney must be re-lined with an approved metallic liner. When this is done, the chimney will be considered NOT exposed to the outdoors and the requirements for NON-exposed chimneys and/or local codes will apply.
2. If an exposed tile-lined chimney is to be used WITHOUT a metallic liner, the boiler must first meet the requirements of the following tables and paragraphs of the National Fuel Gas Code:
 - I. For Single Sentinel Boiler—Paragraph 11.2.9 and table 11.11.
 - II. For multiple appliances—Paragraph 11.3.18 and table 11.12 (or 11.13 if applicable).

In addition, all requirements of the local gas utility, local building codes and other authorities having jurisdiction apply.

- B. If an existing boiler is removed from a common venting system, the common venting system may be too large for proper venting of the remaining appliances connected to the common vent. Follow the test procedure shown in Appendix "A" on page 19 of this manual to insure proper operation of venting system and appliances.
- C. Inspect for proper and tight construction. Any restrictions or obstructions must be removed. An existing chimney may require cleaning.
- D. Chimney or vent must extend at least 914 mm (3 feet) above any ridge within 3048 mm (10 feet) of the chimney.

MINIMUM CLEARANCES FOR COMBUSTIBLE CONSTRUCTIONS

A. Minimum boiler clearances shall be as follows:

SENTINEL SERIES

MINIMUM CLEARANCES FOR COMBUSTIBLE CONSTRUCTION. MINIMUM ALCOVE AND CLOSET CLEARANCE.

| | |
|--------------------|--------------|
| Front | 152 mm (6") |
| Rear | 152 mm (6") |
| Left Side | 152 mm (6") |
| Right Side | 305 mm (12") |
| Top (above boiler) | 711 mm (28") |
| Flue Connector | 152 mm (6") |

B. Provide accessibility clearance of 510 mm (24") on sides requiring servicing and 457 mm (18") on sides used for passage.

C. All minimum clearances shown above must be met. This may result in increased values of some minimum clearances in order to maintain the minimum clearances of others.

D. Clearance from hot water pipes shall be 25 mm (1 inch)**.

** At points where hot water pipes emerge from a floor, wall or ceiling, the clearance at the opening through the finished floor, wall or ceiling boards may not be less than 13 mm (1/2 inch). Each such opening shall be covered with a plate of non-combustible material.

SAFETY

KEEP THE BOILER AREA CLEAR AND FREE FROM COMBUSTIBLE MATERIALS, GASOLINE AND OTHER FLAMMABLE VAPORS AND LIQUIDS.

DRAFT HOOD

The draft hood supplied with SE models is part of the listed boiler assembly. DO NOT alter the hood. See dimensions, page 2.

Attach the hood to the boiler flue outlet. Connect flue pipe full size of hood outlet. Vent damper must be installed on the outlet side of the hood. See Vent Piping, below.

VENT PIPING

- A. Vent piping installation must be in accordance with the requirements of the local gas utility, local building codes and other authorities having jurisdiction.
- B. Boiler vent pipe must be the full diameter of the boiler outlet. See dimensions, page 2.
- C. If more than one appliance vents into a common breeching, the area of the breeching must be equal to the area of the largest vent plus 50% of the area of the additional vent areas. Vent connectors serving appliances vented by natural draft shall not be connected into any portion of mechanical draft systems operating under positive pressure. Horizontal breeching or vent pipe should be as high as possible, consistent with codes, so that vertical vents from appliances will have a high rise above draft diverter openings. All horizontal runs must slope upwards not less than 20 mm/m (1/4 inch per foot) of run. Horizontal portions of the venting system must be supported to prevent sagging by securing each joint with metal screws and by providing hanger spaced no greater than 1524 mm (5 feet apart).

- D. Vent or breeching into chimney should not be inserted past the inside wall of the chimney liner.
- E. All venting means should be inspected frequently. See Care and Maintenance and separate User's Information Manual.

VENT DAMPER INSTALLATION

The vent damper referred to in the following instructions is the Slant/Fin LTD/LTEE vent damper.

- I. This device is design certified by CSA for use ONLY on specific Slant/Fin gas boiler models. These boilers must also be equipped with a plate which states that the boiler must or may be used with a Slant/Fin automatic vent damper device and indicates the proper vent damper model number. This device cannot be used with a millivolt ignition system.
- II. A. INSTALLATION INSTRUCTIONS BEFORE YOU START TO INSTALL
 1. Read this installation manual, the "DANGER" plate attached to the top of the boiler, the "WARNING" on the wiring diagrams, vent damper carton and operator cover.
 2. Perform pre-installation inspection as required by ANSI specification Z21.66 or CSA B 149.1 latest edition for natural gas and propane.
 3. Turn off all electrical power, gas supply and wait for system to cool (for previously installed boilers).
 4. Carefully unpack the unit. DO NOT FORCE IT OPEN OR CLOSED! Forcing the damper may damage the gear train and void the warranty.
 5. This device must be installed after the appliance draft hood (between the draft hood outlet and the connector to the outdoor chimney or vent) as close to the draft hood as practicable, and without modification of the draft hood or the damper. (See figures 1 and 2.)
 6. The inlet size of the vent damper must be the same nominal trade size as the outlet of the draft hood.
 7. This device must be located in a venting system or section of a venting system so that it serves only the single appliance for which it is installed. (See fig. 5.)
 8. Clearances of not less than 152 mm (6 inches) must be maintained from combustible materials, with provisions for access for service.

WARNING—DANGER

Once you have begun vent damper installation procedure, DO NOT restore electric power and gas supply until installation and inspection have been completed (in order to prevent the main burners from operating). DO NOT operate the boiler until the vent damper harness "FEMALE PLUG" is plugged into "MALE PLUG" (as described in the installation instructions), and the vent damper installation and checkout procedures have been completed. Failure to observe this warning may create a hazardous condition that could cause an explosion or carbon monoxide poisoning.

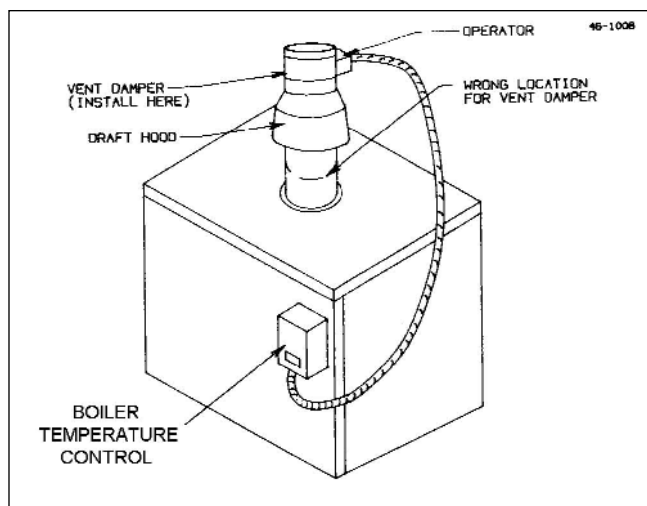


Figure 1.

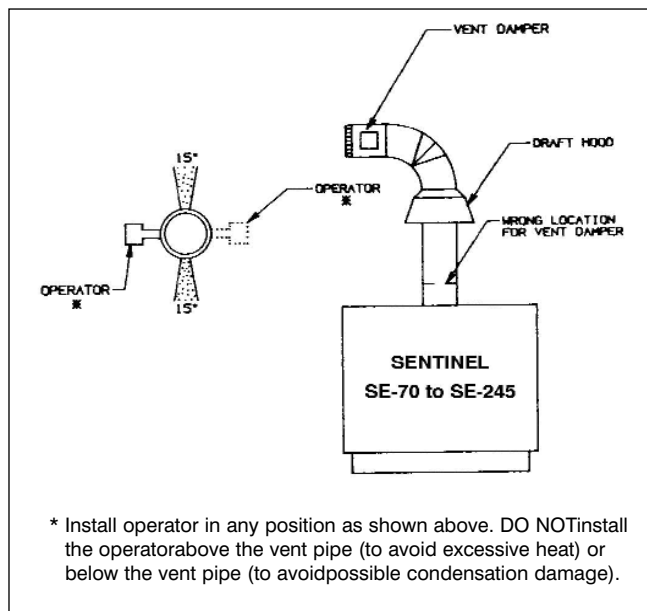


Figure 2.

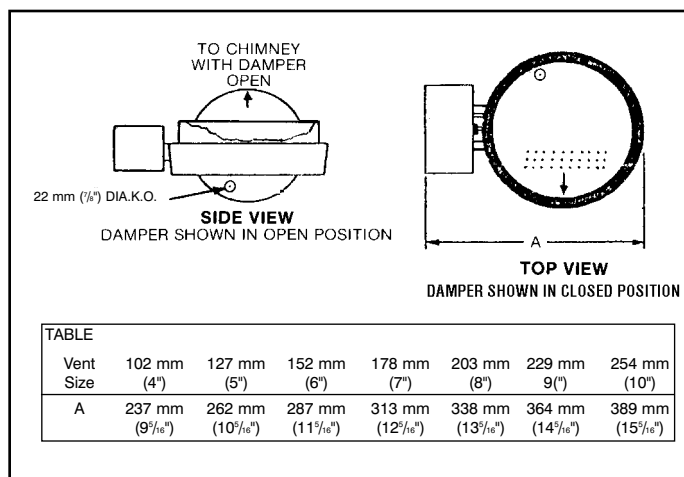


Figure 3. Vent damper dimensions

B. NOW, PROCEED AS FOLLOWS:

1. Separate the vent pipe directly on top of the draft hood or diverter and place damper in position as shown in figures 1-6. The vent damper must be installed so that the damper position indicator is in a visible location after installation. See figure 4 for position indicator description. The arrow imprint on the damper should point in direction of vent gas flow (towards chimney). Re-assemble the vent piping. Be sure the vent damper is well seated and fastened with 3 sheet metal screws. Screws should be no longer than 13 mm (1/2 inch). See figure 6.
2. Be sure that undersized vent pipe does not block movement of damper vane (see figure 4).
3. Boilers that have a vent damper are factory wired with a male plug.
 - a) Attach the flexible metallic conduit vent damper harness to the right hand side of the jacket by passing the free end of the harness through the 22 mm (7/8") diameter hole in the top of the jacket, and using the BX connector at the free end of the metallic conduit, fasten to jacket.
 - b) Connect "FEMALE PLUG" (free end of vent damper harness) into "MALE PLUG" (see correct wiring diagram for both continuous and intermittent pilots).
 - c) The other end of the flexible metal conduit has a small moxex plug and a 90 degree metal conduit connector. Route the moxex receptacle through the conduit bracket on the vent damper. Place the harness receptacle into the damper plug. Securely fasten the harness conduit connector to the conduit bracket by carefully pushing it into the hole in the bracket.
4. Restore electrical power and turn on gas supply.

C. AFTER INSTALLATION:

1. Operate system through two complete cycles to check for opening and closing in proper sequence, and proper burner operation. DAMPER MUST BE IN OPEN POSITION WHEN BOILER MAIN BURNERS ARE OPERATING.
2. Perform installation checks as required by ANSI specification Z21.66 or CSA B 149.1 latest edition for natural gas and propane.
3. Replace the front cover of the boiler.
4. Check the troubleshooting section if problems arise..

D. THERMOSTAT HEAT ANTICIPATOR ADJUSTMENTS

If the 24V room thermostat that controls the boiler has an adjustment heat anticipator, it must be set to the AMP draw of the boiler. Connect the system to the thermostat and run the system. Measure the current draw through the thermostat wires and set anticipator accordingly. See "Appendix C."

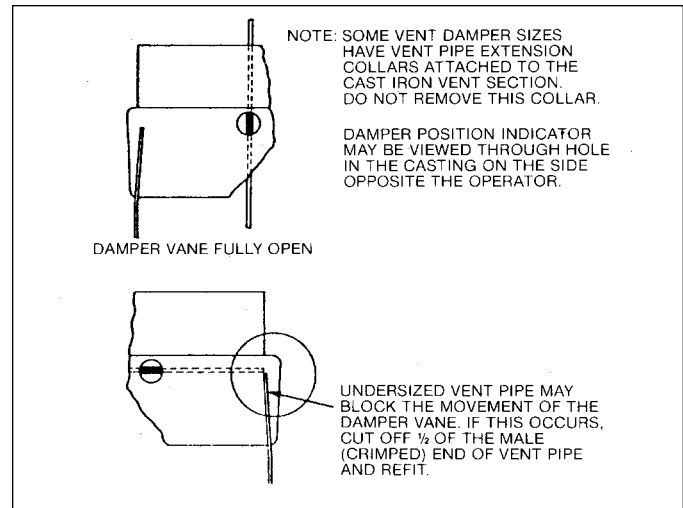


Figure 4.

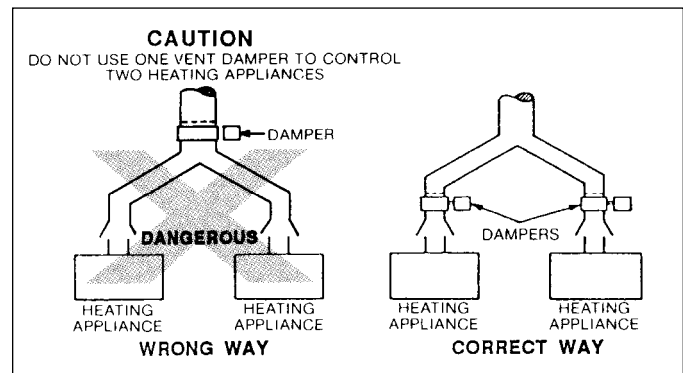


Figure 5.

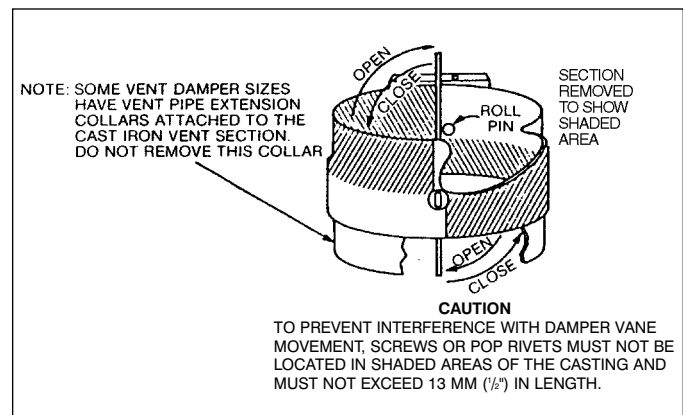


Figure 6.

ELECTRICAL WIRING

DANGER: Before wiring, always turn off electric power supply,

1. Power Supply

A separately fused circuit is recommended. Use a standard 15 Amp. fuse or breaker and 14 gauge conductors in BX cable or circuit.

Provide disconnect means and overload protection as required. See boiler wiring diagram (Figure 7).

Boiler must be electrically grounded in accordance with requirements of the authority having jurisdiction, or, in the absence of such requirements, with the National Electrical Code, ANSI/NFPA 70-latest edition.

2. Power Connection

Connect hot and neutral to L1 and L2 terminal of the boiler control (See Figure 7).

Connect ground wire to ground screw inside boiler control.

3. Thermostat Connections

Thermostat connections must be to T and TV screw terminals of boiler temperature control (See Figure 4).

4. Multi Zoning

For pump zoning system, see Figures 8 and 9, for zone valve system, see Figure 10. DO NOT use boiler transformer to power external accessories like zone valve and relays, overload and/or burned-out transformer and boiler malfunction can result.

ELECTRICAL CONTROLS AND WIRING

- A. The electrical power to the boiler must be on a separately fused and live circuit.
- B. If an external electrical source is utilized, the boiler, when installed, must be electrically grounded in accordance with the requirements of the authority having jurisdiction or, in absence of such requirements, with the Canadian Electric Code – CSA-C22.1, Part 1 – latest edition.
- C. Basic control wiring diagrams are supplied. Other control systems may be factory supplied, see User's Information Manual and Instructions packed with control system supplied.
- D. After placing the boiler in operation, the safety shutoff device must be tested. See page 16 safety check.

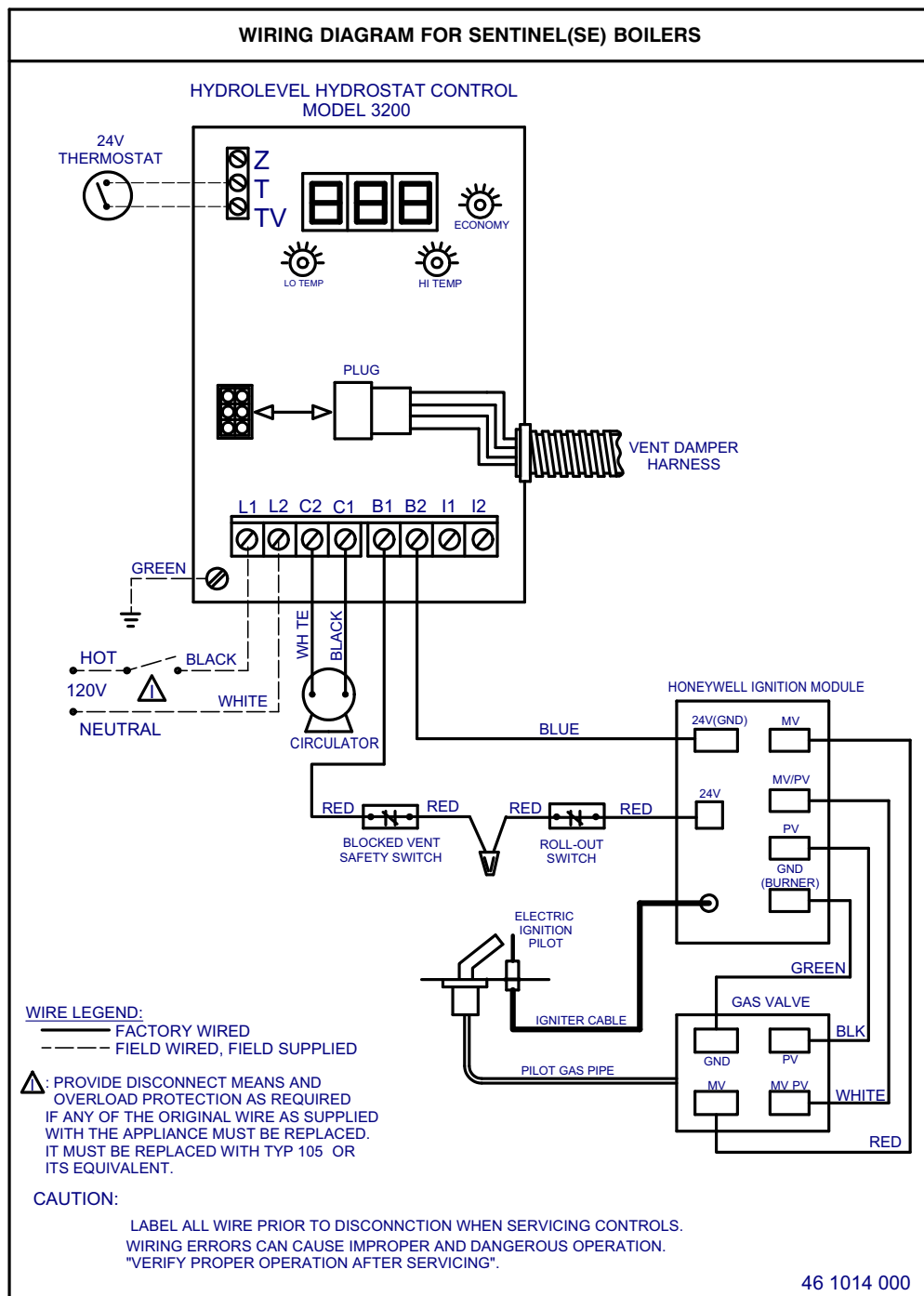


Figure 7

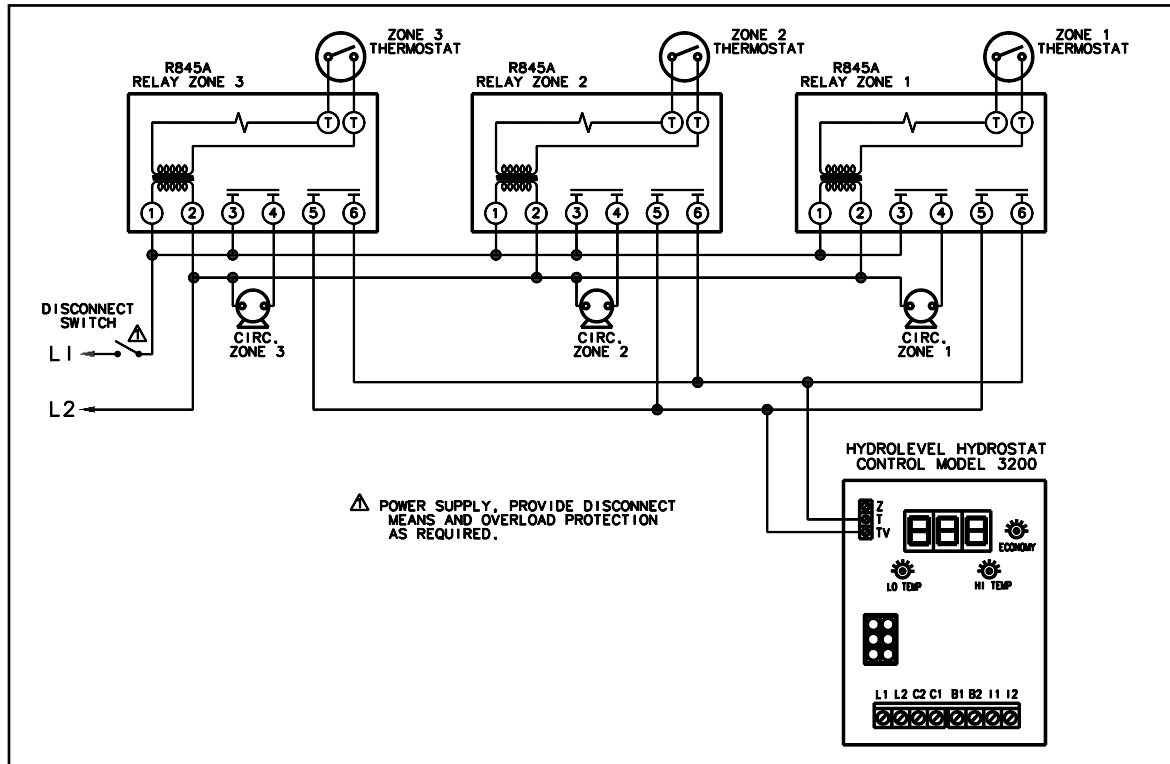


Figure 8. Multizoning of Sentinel boilers pump zoning system using R845A relay.

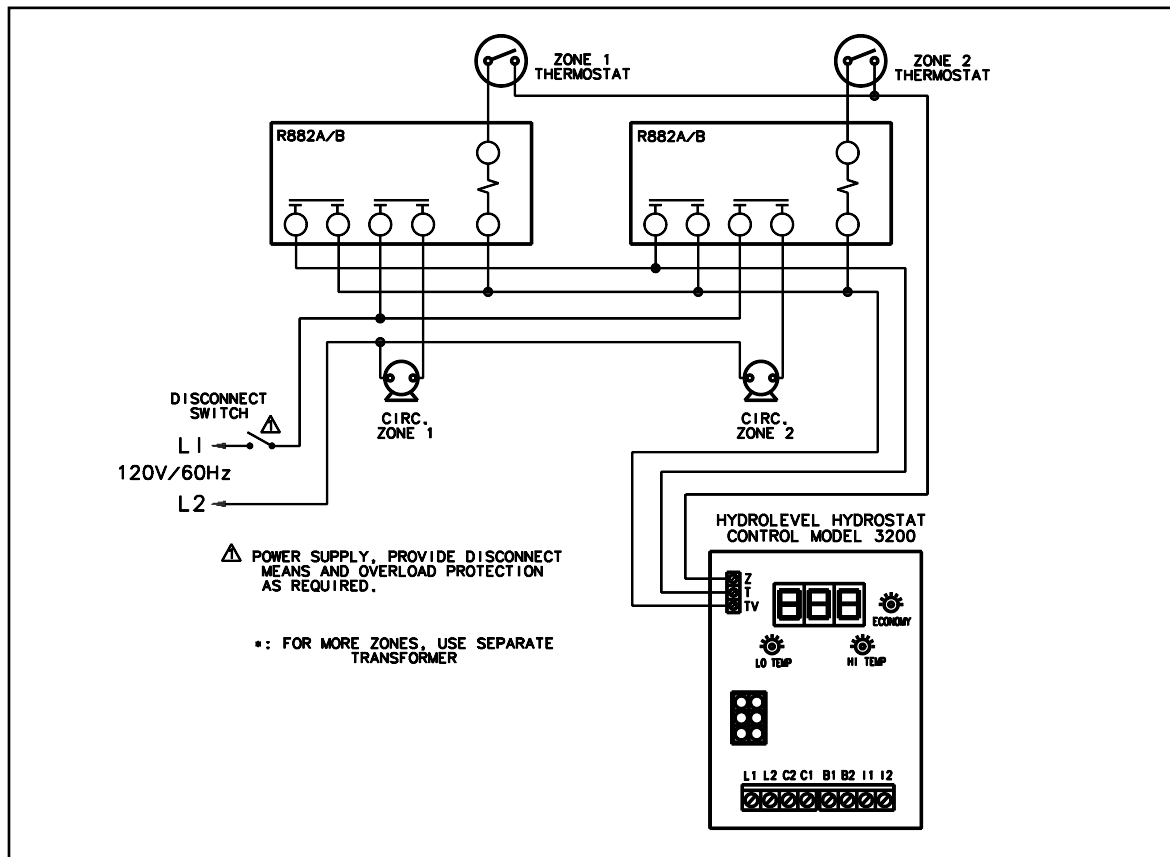


Figure 9. Multizoning of Sentinel boiler-2 zone system pump zoning system using R882A/B relays.

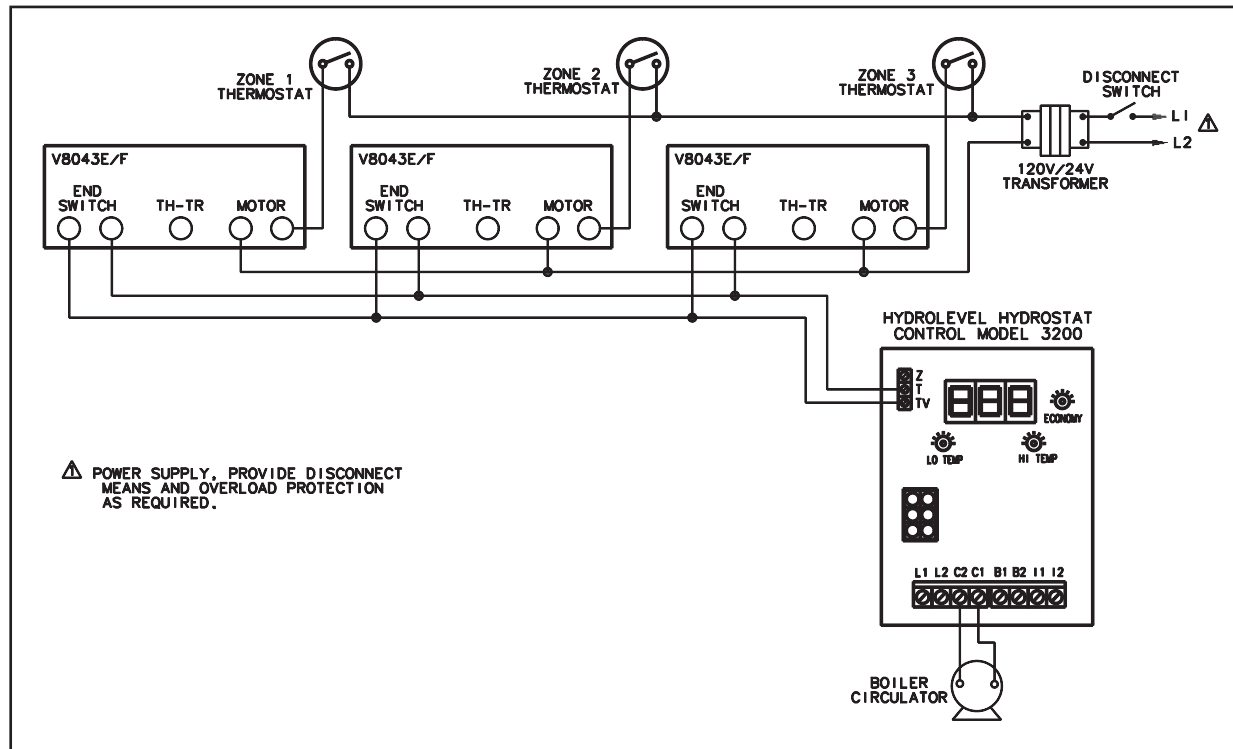


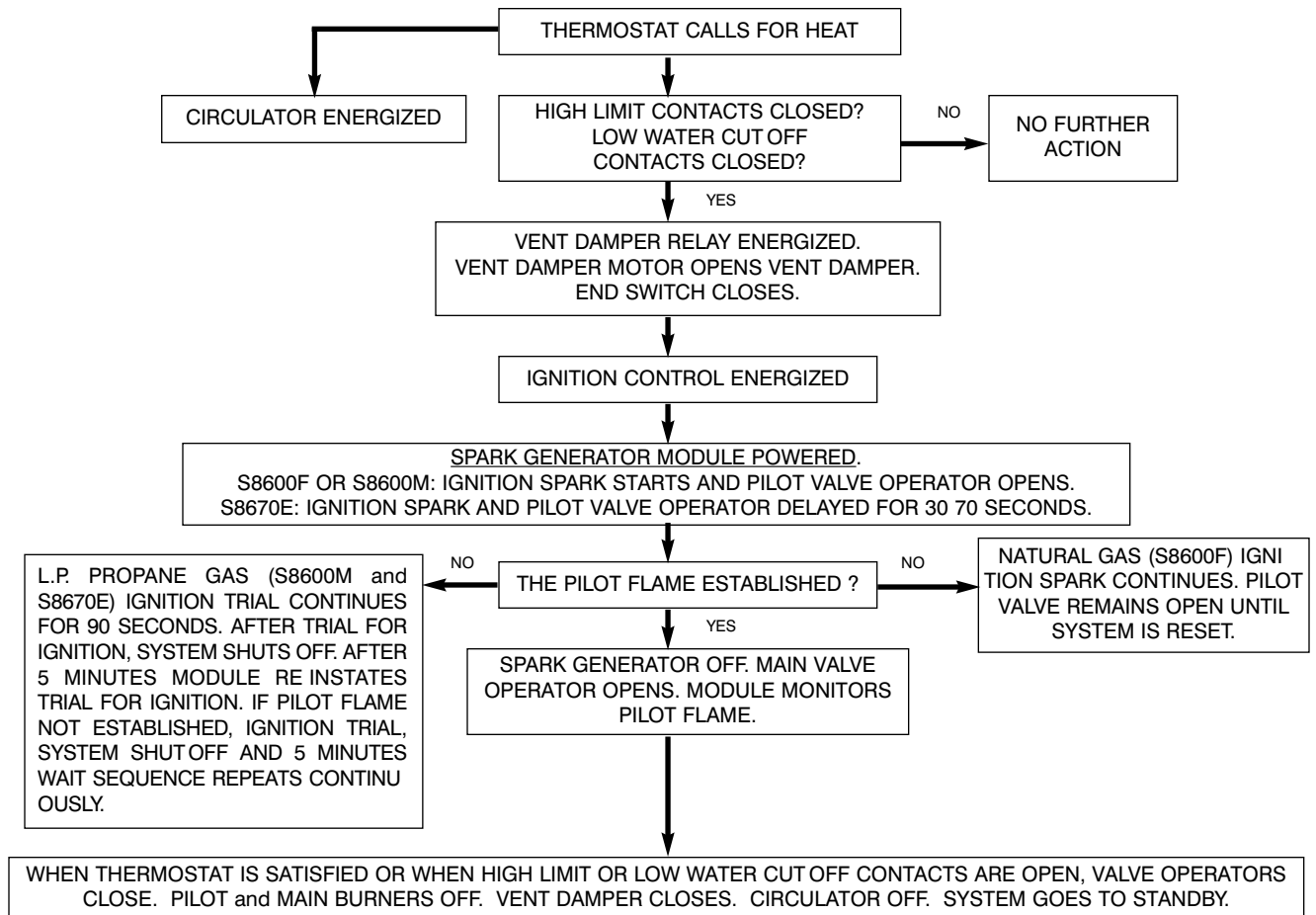
Figure 10. Multizoning of Sentinel boilers zone valve system using R8043E/F zone valves.

IMPORTANT NOTICE

This boiler is equipped with a feature that saves energy by reducing the boiler water temperature as the heating load decreases. This feature is equipped with an override which is provided primarily to permit the use of an external energy management system that serves the same function. **THIS OVERRIDE MUST NOT BE USED UNLESS AT LEAST ONE OF THE FOLLOWING CONDITIONS IS TRUE:**

- An external energy management system is installed that reduces the boiler water temperature as the heating load decreases.
- This boiler is not used for any space heating.
- This boiler has an input of 88kw (300 MBH) or greater
- This boiler is part of a modular or multiple boiler system having a total input of 88kw (300 MBH) or greater.
- This boiler is equipped with a tankless coil.

SEQUENCE OF OPERATION FOR SENTINEL BOILERS



I. BOILERS EQUIPPED WITH HYDROSTAT CONTROL

SETTING THE CONTROL

NOTE: Settings can be checked using the TEST/SETTINGS Button.

SETTING THE HIGH LIMIT

The high limit is factory set at 88°C (190°F). To adjust, turn the HI TEMP Dial **A** until the desired setting is displayed. (Setting range: 38°C–104°C [100°–220°F])

SETTING THE LOW LIMIT

The low limit is designed to maintain temperature in boilers equipped with tankless coils used for domestic hot water. The low limit is factory set to OFF. Prior to adjusting, remove the jumper (not equipped on all units) **B**. Then turn the LO TEMP Dial **C** clockwise until the desired temperature is displayed. For proper operation, the low temperature limit setting should be at least 6°C (10°) below the high limit setting. **NOTE:** For cold start operation, the low limit must be turned OFF. **IMPORTANT:** If low limit temperature cannot be set above 60°C (140°F), remove jumper **B** (Setting range: OFF or 43°C–93°C [110°–200°F]).

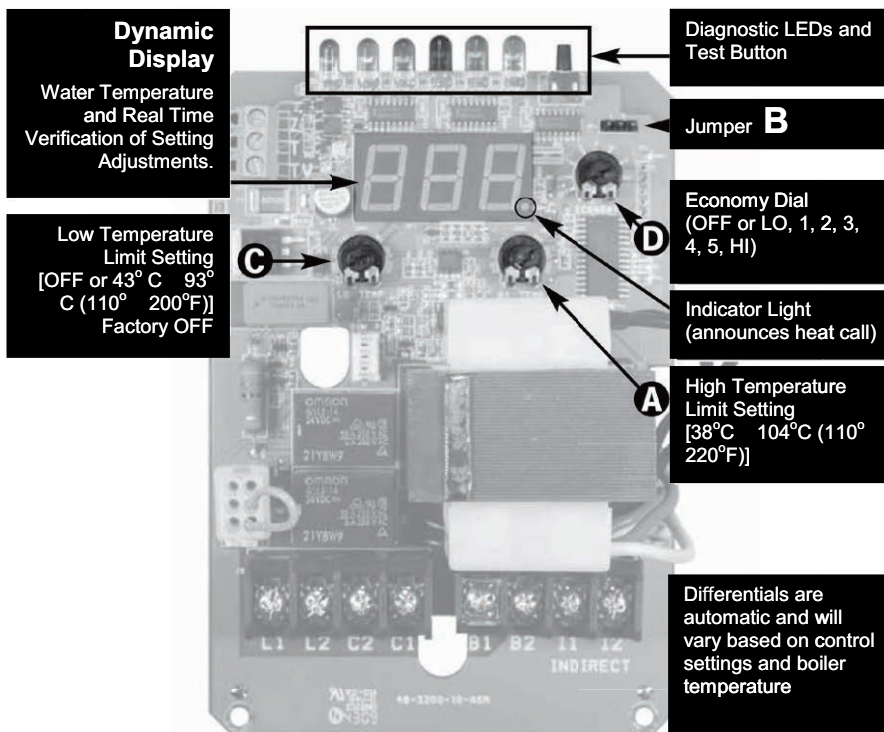
SETTING THE ECONOMY FEATURE

The Economy Feature is factory set for a 1 zone heating system. To adjust, turn the ECONOMY Dial **D** until the number displayed equals the number of heating zones. Do not include indirect water heaters in the number of heating zones. The Economy Feature conserves fuel by reducing boiler temperature (see “How Thermal Targeting Works” below). If the heating system is unable to supply needed heat to the house, the ECONOMY Dial should be turned to a lower setting (example: In a three zone house, turn the dial to 2 or 1). Conversely, if the boiler provides adequate heat, added fuel savings can be achieved by selecting a higher setting (example: 4 or 5). If the heating and indirect water heater signals were not separated when wiring the control, the Economy Feature should be turned OFF to insure the boiler supplies adequate temperature to heat the indirect tank.

ACTIVATING THERMAL PRE-PURGE (OPTIONAL)

NOTE: Activation of this feature is not recommended for boilers with tankless coils.

Fuel Smart HydroStat has a Thermal Pre-Purge feature to maximize efficiency. When activated, the control will purge higher boiler temperatures down to 57°C (135°F) at the start of any thermostat call and supply the latent energy in the boiler to the heating zone that is calling. During the purge cycle, the display will indicate Pur. If the



heat is not sufficient to satisfy the thermostat, the control will energize the burner. This feature works with single- and multi-zone heating systems utilizing circulators or zone valves. No change in wiring is needed.

To Activate Thermal Pre-Purge

Push and hold the TEST/SETTINGS button for 20 seconds. The display will read Pur On. To deactivate the feature, push and hold the button a second time for 20 seconds. The display will read Pur OFF.

| | |
|---------|--|
| SETTING | |
| OFF | Disables economy function. Will allow boiler to fire until hi limit temp is reached and re fire with a 10° subtractive differential. |
| LO | Provides lowest level of fuel savings. Use this setting only if the house does not stay warm at higher settings. |
| 1 | Recommended setting for single zone systems |
| 2 | Recommended setting for Two zone systems |
| 3 | Recommended setting for Three zone systems |
| 4 | Recommended setting for Four zone systems |
| 5 | Recommended setting for Five zone systems |
| HI | Provides highest level of fuel savings |

SYSTEM START-UP

At initial start up, with the Economy Feature active, the control establishes a 63°C (145°F) target temperature. To test the high limit shut-off function, the Economy Dial must be turned to OFF. Once tested, restore the Economy setting. If the heating demand is high, the target will increase over time to satisfy the heat load. **NOTE:** To reduce the potential for condensing, the control will allow the boiler to heat to 49°C (120°F) prior to energizing the circulator.

HOW THERMAL TARGETING WORKS

Thermal Targeting technology analyzes thermostat activity and continually evaluate how much heat the house requires. When it is very cold outside, the heat demand is high and the Fuel Smart HydroStat will raise the boiler's Target temperature to provide needed heat to the home. When the outside temperature is milder, the heat demand is lower. During these periods, the Fuel Smart HydroStat will lower the boiler's Target temperature – saving fuel – while continuing to provide comfort to the house.

LED LEGEND and TEST/SETTINGS BUTTON

① **TEMP ACTIVE** Indicates that the Fuel Smart HydroStat control is powered and that the temperature function is active.

② **TEMP HIGH TEMP** Illuminates when the boiler water temperature reaches the high limit setting. It will remain lit until the water temperature falls 5.5°C (10°F) (see High Limit Differential on page 4). The Fuel Smart HydroStat prevents burner operation while this LED is on.

③ **LWCO ACTIVE** Indicates that the low water cut-off (LWCO) function of the Fuel Smart HydroStat is active. When the control is installed with a Hydrolevel Electro-Well, this LED will be on at all times when the control is powered.

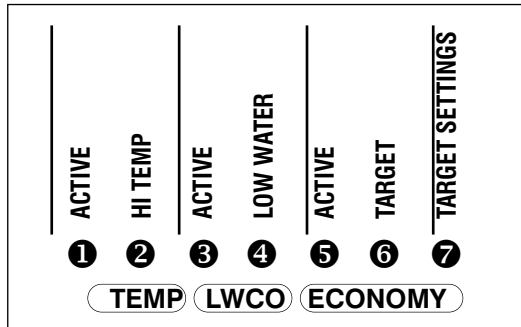
IMPORTANT: If the control is installed with a well other than the Electro-Well, this LED will not illuminate indicating that the control is not providing low water cut-off functionality.

④ **LWCO LOW WATER** Illuminates if the boiler is in a low water condition. The Fuel Smart HydroStat will prevent burner operation during this condition. **IMPORTANT:** The system must be checked by a qualified heating professional prior to resuming operation.

WARNING: DO NOT ADD WATER UNTIL THE BOILER HAS FULLY COOLED.

⑤ **ECONOMY ACTIVE** Indicates that the Thermal Targeting function is active and the Fuel Smart HydroStat will reduce boiler temperature to conserve fuel. The Economy feature is activated using the ECONOMY dial. (See “How Thermal Targeting Works” on page 4 for more information).

⑥ **ECONOMY TARGET** When the Economy feature is active, the Fuel Smart HydroStat continually sets target temperatures below the high limit setting to maximize fuel efficiency. When the boiler



water reaches the target temperature, the LED illuminates and the burner will shut down. The boiler water will continue to circulate and heat the house as long as the thermostat call continues. The LED will stay lit until the boiler temperature drops to the differential set point (see Target Temp Differential on page 4) at which point the boiler will be allowed to fire again. **NOTE:** This LED illuminates regularly during normal boiler operation.

⑦ TEST/SETTINGS Button

To Test Low Water Cut-Off: Press and hold the Test/Settings button for 5 seconds. The display will read LCO.

LWCO TEST LCO

The red Low Water light should illuminate and the burner circuit (B1 and B2) should de-energize. **NOTE:** The control must be installed with a Hydrolevel Electro-Well for low water cut-off functionality (see page 2 for more details).

To View Current Settings: Press and release the Test/Settings Button in short intervals to sequentially display the following settings:

HIGH LIMIT SETTING HL
▼
LOW LIMIT SETTING LL
▼
ECONOMY SETTING ECO
▼
CURRENT TARGET TEMPERATURE °°°
▼
PRE-PURGE SETTING Pur

The display will return to boiler temperature (default) if Test/Settings Button is not pressed for 5 seconds.

GAS PIPING

- A. Local installation codes apply. The pipe joint compound used on threads must be resistant to the action of liquefied petroleum gases.
- B. The gas supply line to the boiler should be run directly from the meter for natural gas or from the fuel tank for L.P. propane gas. See page 2 for location of union and manual main shutoff valve that may be specified locally.

Selecting pipe size for natural gas:

1. Measure or estimate the length of piping from the meter to the installation site.
2. Consult gas supplier for heating value of gas-W/m³ (BTU/cu. ft.).
3. Divide boiler rated input by heating value to find gas flow in piping (m³/hr) (cu. ft. per hour).
4. Use table below to select proper pipe size.

Example: Boiler model SE-175 is to be installed. Distance from gas meter to the boiler is 6.1m (20 ft). Heating value of natural gas is 10560 W/m³ (1020 BTU/cu. ft.) Select proper pipe size.

$$\begin{aligned} \text{Gas flow} &= \frac{51\,290 \text{ W/hr}}{10\,560 \text{ W/m}^3} = 4.9 \text{ m}^3/\text{hr} \\ \text{At 6.1m} & \\ (\text{Gas flow} &= \frac{175,000 \text{ BTU/hour}}{1020 \text{ BTU/cu. ft.}} = 171.5 \text{ cu. ft. per hour}) \end{aligned}$$

(20 ft.) length of pipe, match required capacity from table below (choose higher capacity, in this case is 5.4 m³ [190 cu. ft.] per hour). Required pipe size is 3/4".

Improper gas pipe sizing will result in pilot flame outages, insufficient heat and other installation difficulties. For more information and also if other appliances are to be attached to the piping system, see Appendix C of National Fuel Gas Code ANSI Z2231 latest edition or CSA B 149.1 latest edition for natural gas and propane.

- C. The boiler and its gas connection must be leak tested before placing the boiler in operation. Use liquid soap solution for all gas leak testing. Do not use open flame.

This boiler and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 3.5 kPa (1/2 PSIG). This boiler must be isolated from the gas supply piping system by closing its individual manual

shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 3.5 kPa (1/2 PSIG).

- D. All gas piping used should be inspected thoroughly for cleanliness before makeup. A sediment trap must be provided, as illustrated on page 2.
- E. The minimum and maximum gas supply pressure (at the inlet of gas valve) are shown on the boiler rating plate for the type of gas used. Gas supply pressure should never be less than minimum or more than maximum pressure when the boiler or any other appliance is turned on or off.

BOILER ROOM AIR SUPPLY AND VENTILATION

An ample supply of air is required to obtain combustion and ventilation. **ALL AIR COMES FROM OUTSIDE**, directly through wall openings to the boiler or through unsealed openings around windows, doors, etc. in the whole building. When buildings are insulated, caulked and weather stripped, now or later on, direct openings to outside may be required and should be provided. If the boiler is not near an outside wall, air may be ducted to it from outside wall openings.

Provisions for combustion and ventilation air must be made in accordance with section 5.3, Air for Combustion and Ventilation, of the National Fuel Gas Code, ANSI Z2231 latest edition or CSA B 149.1 latest edition for natural gas and propane, or applicable provisions of the local building codes. The following recommendation applies to buildings of energy-saving construction, fully caulked and weather stripped:

INSTALLATION IN ENCLOSED BOILER ROOM REQUIRES TWO UNOBSTRUCTED OPENINGS FOR PASSAGE OF AIR INTO THE BOILER ROOM:

1. Air drawn horizontally from outdoors **DIRECTLY** through an outside wall; one louvered opening near the floor and one louvered opening near the ceiling, each opening with a minimum **FREE** air passage area of 550 mm² per kW (1 square inch per 4000 BTUH) of total appliances' input.
2. Air drawn horizontally through **HORIZONTAL DUCTS**; one opening near the floor and one opening near the ceiling, each opening with a minimum **FREE** air passage area of 1100 mm² per kW (1 square inch per 2000 BTUH) of total appliances' input.
3. Air drawn **VERTICALLY** from outdoors; one opening at the floor and one opening at the ceiling, each opening with a minimum **FREE** air passage area of 550 mm² per kW (1 square inch per 4000 BTUH) of total appliances' input.
4. Air drawn from inside the building; one opening near the floor and one opening near the ceiling, each opening with a minimum **FREE** air passage area of 2200 mm² per kW (1 square inch per 1000 BTUH) of total appliances' input.

IF BOILERS ARE INSTALLED ADJACENT TO OTHER FUEL BURNING EQUIPMENT, THE AREA OF FREE OPENINGS MUST BE APPROPRIATELY INCREASED TO ACCOMMODATE THE ADDITIONAL LOAD.

Openings must never be reduced or closed. If doors or windows are used for air supply, they must be locked open. Protect against closure of openings by snow and debris. Inspect frequently.

No mechanical draft exhaust or supply fans are to be used in or near the boiler area.

The flow of combustion and ventilating air to the boiler must not be obstructed.

| Length of Pipe | | Gas Flow In Piping Pressure drop=8mm(0.3") water column, 0.60 specific gravity gas. | | | | | |
|----------------|-----|--|-------------------------------|-------------------------------|-------------------------------|-------------------------------|--|
| | | Iron Pipe Size (Ips) inches | | | | | |
| | | 1/2" | 3/4" | 1" | 1 1/4" | 1 1/2" | |
| m | ft | m ³ /hr cu.ft./hr. | m ³ /hr cu.ft./hr. | m ³ /hr cu.ft./hr. | m ³ /hr cu.ft./hr. | m ³ /hr cu.ft./hr. | |
| 3.0 | 10 | 3.7 132 | 7.9 278 | 14.7 520 | 29.7 1050 | 45.3 1600 | |
| 6.1 | 20 | 2.6 92 | 5.4 190 | 9.9 350 | 20.7 730 | 31.1 1100 | |
| 9.1 | 30 | 2.1 73 | 4.3 152 | 8.1 285 | 16.7 590 | 25.2 890 | |
| 12.2 | 40 | 1.8 63 | 3.7 130 | 6.9 245 | 14.2 500 | 21.5 760 | |
| 15.2 | 50 | 1.6 56 | 3.3 115 | 6.1 215 | 12.5 440 | 19.0 670 | |
| 18.3 | 60 | 1.4 50 | 3.0 105 | 5.5 195 | 11.3 400 | 17.3 610 | |
| 21.3 | 70 | 1.3 46 | 2.7 96 | 5.1 180 | 10.5 370 | 15.9 560 | |
| 24.3 | 80 | 1.2 43 | 2.5 90 | 4.8 170 | 9.9 350 | 15.0 530 | |
| 27.4 | 90 | 1.1 40 | 2.4 84 | 4.5 160 | 9.1 320 | 13.9 490 | |
| 30.5 | 100 | 1.1 38 | 2.2 79 | 4.2 150 | 8.6 305 | 13.0 460 | |

At pressure drop of 0.3 in. water, specific gravity = 0.60 gas.

WATER PIPING

I. CIRCULATING SYSTEMS

- A. Hot water heating systems include a water circulating pump which may be mounted on the supply or return side of the boiler based on system design. See figure 5.

II. AIR CONTROL SYSTEM

- A. DIAPHRAGM EXPANSION TANKS are used to control system pressure in an AIR ELIMINATING SYSTEM: an automatic air vent is used to REMOVE air from the system water. See figure 9. If system pressure needs further control, add an additional tank or install a larger capacity tank. Locate the tank near the boiler, as illustrated. An automatic air vent should be installed in the top of the boiler or air purger. See figure 9.
- B. PUMP LOCATION — Locating low-head pump(s) on return to boiler is acceptable for smaller boiler sizes in residences of one or two stories. The alternate pump location shown in illustration is required in large, multi-story building installations, especially when high-head pumps are used. The expansion tank must be at the boiler or between boiler and supply main pump(s).

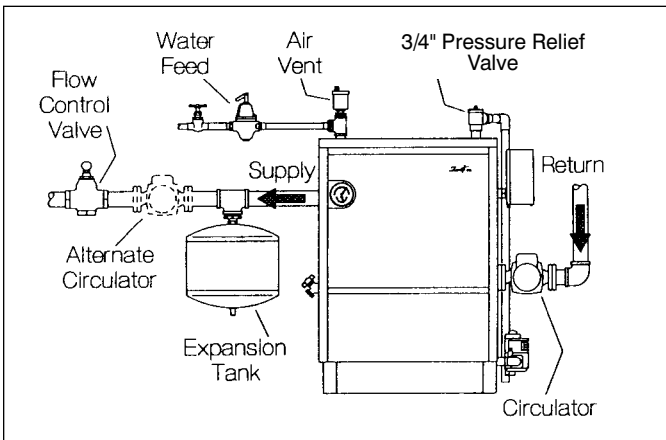


Figure 9. Piping arrangement

IMPORTANT: Hot water heating systems containing high water volume, such as would occur with cast-iron radiation, require special care with air elimination.

The circulating pump should be located on the boiler supply pipe and the expansion tank and air scoop should be located near the pump suction.

- C. On a hot water boiler installed above radiation level, the boiler must be provided with a low water cutoff device at the time of installation by the installer.

OPERATING INSTRUCTIONS

I. FILLING AND VENTING WATER SYSTEMS

- A. Fill the system with water. Vent or purge off air.
- B. Fire the boiler as soon as possible (see following warning and instructions) and bring water temperature to at least 82°C (180°F), while circulating water in the system.
- C. Vent air and add water as needed to achieve operating pressure on boiler gauge. Pressure must be between approximately 83 kPa (12 psi) (cold water) and 172 kPa (25 psi) (at water temperature setting of high limit control), for boilers equipped with 207 kPa (30 psi) relief valves. Boilers rated for a higher pressure and equipped with a matching relief valve may operate at a higher pressure, but no higher than 34 kPa (5 psi) below the relief valve opening pressure.

- D. Check for and repair any leaks before placing system in service.

Before firing boiler, make these checks:

1. System is full of water. Air is vented or purged.
2. Relief valve is installed in accordance with the ASME Boiler Pressure Vessel Code, Section IV. Valve opening is not closed or reduced in size.
3. Venting is installed according to instructions under "VENT PIPING".
4. All wiring is completed, following applicable wiring diagrams.
5. Using soap solution, check for gas leaks in all gas piping from meter to boiler pilot and manifold. Do not use open flame.

1. Intermittent Pilot System (IID).

FOR BOILERS EQUIPPED WITH HONEYWELL GAS VALVE VR8204 or VR8304 (see figures 12 and 13).

SAFETY INFORMATION

FOR YOUR SAFETY READ BEFORE LIGHTING



WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life.

- A. This appliance is equipped with an ignition device which automatically lights the pilot. Do not try to light the pilot by hand.
- B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some gas is heavier than air and will settle on the floor.

WHAT TO DO IF YOU SMELL GAS

- Do not try to light any appliance.
 - Do not touch any electric switch; Do not use any phone in your building.
 - Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department.
- C. Use only your hand to push in or turn the gas control knob. Never use tools. If the knob will not push in or turn by hand, don't try to repair it, call a qualified service technician. Force or attempted repair may result in a fire or explosion.
- D. Do not use this appliance if any part has been under-water. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system and any gas control which has been underwater.

Operating Instructions

1. STOP! Read the safety information above.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. This appliance is equipped with an ignition device which automatically lights the pilot. DO NOT try to light the pilot by hand.
5. Remove control access panel.
6. Turn gas control knob clockwise  until knob stops then continue to "OFF". DO NOT force.
7. Wait five (5) minutes (longer for propane) to clear out any gas, then smell for gas, including near the floor. If you then smell gas, STOP! Follow "B" in the safety information above on this page. If you don't smell gas, go to next step.
8. Turn gas control knob counterclockwise  to "ON".
9. Replace control access panel.
10. Turn on all electric power to the appliance.
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "To Turn Off Gas To Appliance" and call your service techni-

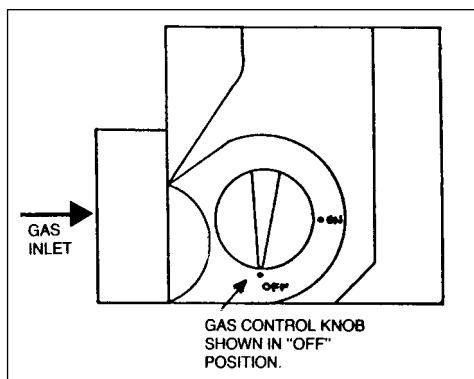


Figure 11. Valve VR8204 or VR8304

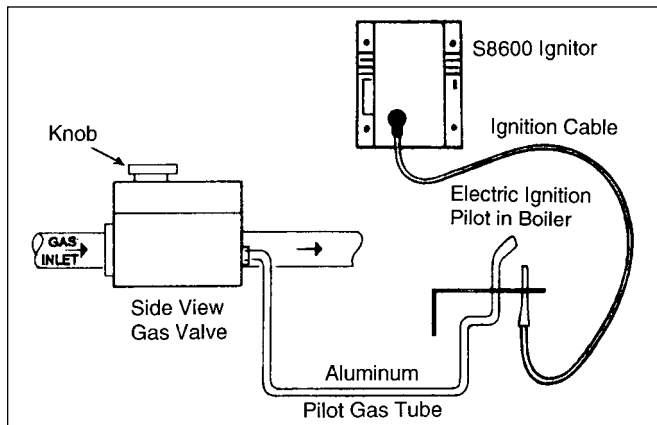



Figure 12.

cian or gas supplier

To Turn Off Gas To Appliance

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove control access panel.
4. Turn gas control knob clockwise  until knob stops, then continue to "OFF". DO NOT force.
5. Replace control access panel.

III. BURNER ADJUSTMENT

A. Adjust gas input rate:

1. Consult gas supplier for higher* heating value of gas – W/m³ (Btu/cu.ft.)
2. Set thermostat high enough so that boiler will remain on while checking rate.
3. Measure manifold pressure at 1/8" tapping. Correct manifold pressure for gas used is printed on boiler rating plate. NOTE: Gas pressure may be adjusted by turning pressure regulator screw on combination gas valve (turn clockwise to increase pressure, counterclockwise to decrease pressure).
 - a. Input for PROPANE is approximately at rating shown on rating plate when manifold pressure is 241 mm (9 1/2") water column.
 - b. Input for NATURAL GAS is approximately at rating when manifold pressure is 89 mm (3 1/2") water column, but should be checked on the gas meter:
 Input = W/m³ × m³ metered in 3 minutes × 20
 (Input = Btu/cu. ft. × cu. ft. metered in 3 minutes × 20)

Example #1:

For 8.29 W/m³ gas, this becomes:

Input = m³ metered in 3 minutes × 8.29 × 20

(For 1000 Btu/cu.ft. gas, this becomes:

Input = cu. ft. metered in 3 minutes × 1000 × 20)

Example #2:

For 8.70 W/m³ gas this becomes:

Input = m³ metered in 3 minutes × 8.70 × 20

(For 1050 Btu/cu.ft. gas, this becomes:

Input = cu. ft. metered in 3 minutes × 1050 × 20)

4. The higher heating value* of gas varies substantially for different localities. Consult with Slant/Fin's Technical Service Dept. for re-orificing procedures if any of the following apply:

- a. Boiler (burner) is overfiring. CAUTION! National Fuel Gas Code ANSI Z223.1-latest edition or CSA B149.1-00 for natural gas and propane, does NOT permit firing at a higher input rate than the input rate indicated on the boiler rating plate in order to avoid hazardous conditions such as explosion or carbon monoxide poisoning.
- b. Poor higher heating value* of gas is causing the actual input to be substantially lower than the rating plate indication.

* "Higher heating value" of gas is commonly known as a "heating value."

The gas metered in 3 minutes to obtain rated input for each boiler model, using 8.29 W/m³ (1000 Btu/cu.ft.) gas is tabulated below:

| BOILER RATED INPUT 8.29 W/m ³ (1000 Btu/cu. ft.) Natural Gas | | GAS CONSUMPTION 8.29 W/m ³ (1000 Btu/cu. ft.) in 3 minutes, at rated input | |
|---|------------|---|--------|
| m ³ /hr | cu.ft./hr. | m ³ | cu.ft. |
| 1.98 | 70 | 0.099 | 3.50 |
| 2.97 | 105 | 0.149 | 5.25 |
| 3.96 | 140 | 0.198 | 7.00 |
| 4.95 | 175 | 0.248 | 8.75 |
| 5.94 | 210 | 0.297 | 10.50 |
| 6.93 | 245 | 0.347 | 12.25 |

B. Main Burners

1. Fire the boiler continuously for at least 15 minutes, to reach burner operating temperature.
2. Observe the flames, all burners. The base of all flame jets should be blue. The tips should be blue shading to orange. NOTE: Dust, disturbed by any movement, will cause bright orange flames. Wait for dust to settle.
3. For one burner, close the air shutter until some of its flame jet tips turn yellow-white, indicating insufficient primary air. Then open shutter until whitish tips disappear completely. Set all burner shutters to the same opening. Observe to make sure that no yellow-white tips appear over any portion of the flame. Small yellow tips at the pilot location are permitted. NOTE: This adjustment method gives MINIMUM primary air setting for safe combustion. DO NOT attempt to make this adjustment unless burners are at operating temperature. Adjustment should be made with burner access panel in final operating position. Use of a mirror may be helpful to observe flames. Note that burner ports are on top of main burner tube.

C. Main Burner Ignition Checkout and Pilot Adjustment.

1. The pilot flame must not smother or snuff out when tested as follows:
 - a. Main burner ignition from cold start – repeat.
 - b. Continued operation of main burner.
 - c. Main burner ignition with appliance at maximum operating temperature after prolonged operation.

NOTE: Observe operation of the pilot burner with appliance doors in the final operating position. Use of a mirror may be helpful.

2. Safety Shutdown Checkout

- a. For proper operation the pilot should engulf the thermo-

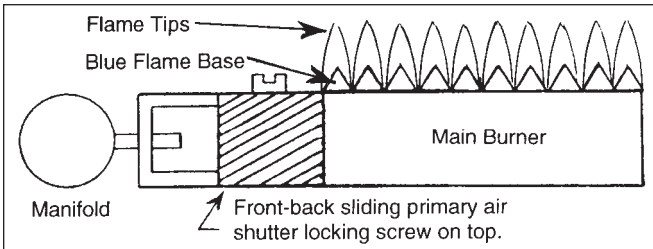


Figure 13.

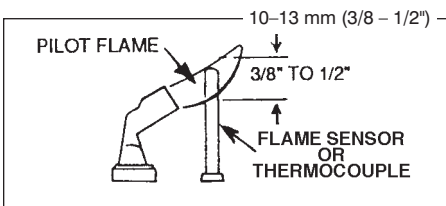


Figure 14.

couple or flame sensor as shown above.

- b. To adjust pilot, turn pilot flow adjustment screw on valve clockwise or counterclockwise to give a steady flame enveloping 10 mm to 13 mm (3/8 to 1/2 inch) of the tip of the thermocouple or flame sensor. Note that turning the pilot adjust screw clockwise will decrease the pilot flame.
- c. Check safety shutdown of gas valve by following procedure outlined in "CARE and MAINTENANCE" section.

CARE AND MAINTENANCE

WARNING: THE FLOW OF COMBUSTION AND VENTILATING AIR TO THE BOILER SHOULD NOT BE OBSTRUCTED.

This section must be brought to the attention of the owner by the installer so that the owner can make the necessary arrangements with a qualified service agency for the periodic care and maintenance of this boiler. The installer must inform the owner that the gas supplier can recommend a number of qualified service agencies. The installer must also inform the owner that the lack of proper care and maintenance of this boiler and any fuel burning equipment may result in a hazardous condition.

1. GENERAL MAINTENANCE (Refer also to Owner's Information Manual)

These operations are recommended to be performed at regular intervals:

- A. **BOILER HEATING SURFACES:** clean off all coatings found.
- B. **BOILER CONTROLS:** check contacts, settings, correct functioning.
- C. **PIPING:** check piping and accessories for leaks.
- D. **CHIMNEY VENTING SYSTEM:** check for obstructions and leaks.

- E. **BOILER ROOM AIR SUPPLY:** check air supply openings for continued POSITIVE supply of air as required. Air needs are greatest in cold weather. Air vents must be open and free of obstruction.

F. WATER SYSTEM CHECK:

1. System to be full of water, and pressure to remain stable at correct setting on gauge.
2. Air control system: noise and air binding in system should be corrected.
3. Water lines: slightest leaks should be corrected.
4. Low water cutoff, for operation (see instructions furnished with unit).

2. WATER LEVEL CHECK DURING HEATING SEASON

- A. Check water pressure regularly and add water slowly to system when needed. If much water is added, venting may be necessary.
- B. Regular loss of water from water boiler system may indicate either a system leak, or a faulty air control system, or a faulty automatic fill valve, or a faulty relief valve.

3. ANNUAL INSPECTION AND CLEANING

- A. It is important that this boiler be inspected by a competent serviceperson to help insure safe and reliable operation.
- B. Check for gas leaks from valve and gas piping to burners and pilot. If leaks are found, repair or replace as required.
- C. This inspection should include:
 1. Controls check. See "Safety Check for Control System" (Section 4) below.
 2. Recheck of input gas rate to burners. See "Initial Start" paragraph in "Operating instructions" section.
 3. Re-adjusting for best flame characteristics of main flame and pilot(s). See "Initial Start" paragraph in "Operating Instructions" section and see "Burner Adjustment" section.
 4. Burner and boiler flue passage cleanliness: **BURNER AND FLUE CLEANING** (see figure 15). It is suggested that paper be placed on burners to collect any foreign material when cleaning flues.
 - a. Remove jacket top and flue cover.
 - b. Use wire brush to clean flueways.
 - c. Replace flue cover and re-seal with furnace cement. Replace jacket top. Remove and dispose of paper and accumulated material.
 - d. If burner surfaces are not clean, or if uneven flame indicates plugged burner ports, remove and clean burners.

NOTE-TO REMOVE BURNERS:

1. Disconnect pilot at pilot mount, or disconnect pilot gas line at gas valve, before removing burners next to pilot.
2. Remove burner mounting clip.
3. Lift burner and remove burner from orifice.
4. Clean and replace burners* and pilot. Adjust burners as described on page 16.

*To clean burners run a clean flue brush up the tube until all foreign matter is removed.

4. SAFETY CHECK FOR CONTROL SYSTEM

- A. High limit control test: Set thermostat high enough for boiler water temperature to reach high limit control setting. When this temperature is reached, the high limit switch should open, and the main gas valve should

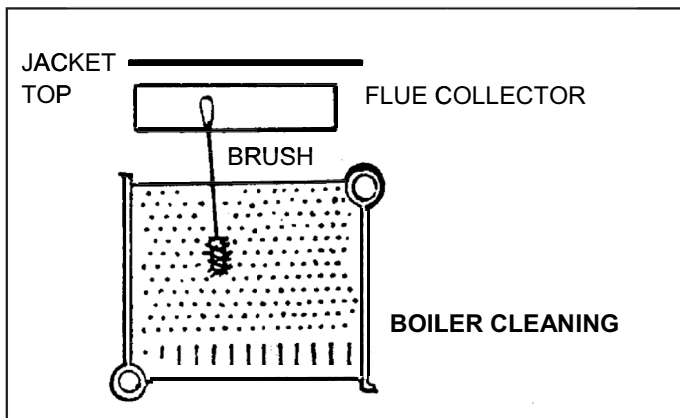


Figure 16

close automatically. If the high limit does not operate to close the main gas valve, the valve, the high limit or the wiring is faulty. Repair or replace immediately.

B. Gas valve safety shutdown test:

1. For boiler equipped with constant burning pilot, with main burners firing, disconnect the thermocouple or thermopile generator from the gas valve. The gas valve should immediately shut off the main burners and the pilot.
2. For boilers equipped with Honeywell S8600 intermittent pilot system, with main burners firing, disconnect the ignition cable from the S8600 IGNITOR BOX. The gas valve should shut off the main burners.

C. Check for gas leaks from valve and gas piping to burners and pilot. If leaks are found, repair or replace as required.

5. PROVIDING PROTECTION FROM FREEZING

A. Anti-freeze is sometimes used in hydronic heating systems to protect against freeze-up in the event of power failure or control shutdown when the building is unoccupied. It should be recognized that unless the building is kept above freezing temperature by some means, the plumbing system is not protected.

Two types of anti-freeze may be used: ETHYLENE GLYCOL, has desirable properties, but is toxic. Its use may

be prohibited when system water/glycol solution is in contact with a potable water vessel (as with a tankless heater). PROPYLENE GLYCOL is used in the quick-freeze food industry; it is practically non-toxic. Its use may be permitted when tankless heaters are used. When anti-freeze must be used, inhibited propylene glycol is recommended. Useful information on the characteristics, mixing proportions, etc. of glycol in heating systems is given in Technical Topics No. 2A, available from the Hydronics Institute 34 Russo Place, Berkeley Heights, NJ 07922. Consult glycol manufacturers for sources of propylene glycol.

B. Water Treatment:

A good water treatment program will not only extend the useful life of this boiler but it will also save much of the time and expense of repairs made necessary by preventable occurrences.

A reputable water treatment company should be consulted to evaluate and determine the best overall treatment program for your boiler equipment.

6. KEEP THE BOILER AREA CLEAR AND FREE FROM COMBUSTIBLE MATERIALS, GASOLINE, AND OTHER FLAMMABLE VAPORS AND LIQUIDS.

WARNING:

The ceramic combustion chamber in the burner box contains crystalline silica.

Wear proper dust mask and gloves when servicing combustion chamber of burners.

Crystalline silica has been identified as a carcinogenic or possibly carcinogenic to humans.

BURNERS FAIL TO OPERATE**CAUSE**

1. Safety pilot out, or flame too low.
2. Gas supply valve shut off.
3. Electric switch open.
4. Blown or defective line fuse.
5. Operating or limit control contacts open or dirty.
6. Defective gas valve or pressure regulator; or plugged bleed line.
7. Defective low voltage transformer.
8. Obstruction at main burner orifice.
9. Break in wiring or loose contact at control terminals.
10. Improper wiring.
11. Improper controls.
12. Rollout or blocked vent safety switch open.

REMEDY

1. Check, clean, re-light. See instructions.
2. Open gas valve(s).
3. Close switch.
4. Replace fuse.
5. Check control. Clean contacts or replace control.
6. Repair or replace.
7. Replace transformer.
8. Check, clean and reinstall.
9. Check with test-light and correct.
10. Check and correct in accordance with wiring diagrams included with appliance instructions.
11. Install proper controls.
12. Replace rollout switch (inspect flue passages prior to replacement) or reset blocked vent safety switch by depressing the reset button.

BURNERS WILL NOT SHUT OFF**CAUSE**

1. Defective operating control, gas valve, or high limit control.
2. Improper wiring or short circuit.

REMEDY

1. Check, repair or replace.
2. Check wiring and controls.

FLASH BACK—BURNING AT ORIFICES**CAUSE**

1. Manifold gas pressure too low.
2. Improper primary air adjustment.
3. Gas regulator bleed too slow.
4. Burrs on orifice.
5. Improperly drilled orifice plugs.
6. Leaking automatic gas valve.
7. Adverse draft condition in boiler room.
8. Low main gas pressure.
9. Safety pilot improperly installed.

REMEDY

1. Adjust to proper manifold pressure.
2. Adjust air to produce soft, clean flame.
3. Adjust bleed opening.
4. Remove burrs.
5. Install orifice plugs with proper drilling.
6. Repair or replace.
7. Check air supply and venting system.
8. Contact utility.
9. Correct to manufacturer's recommendations.

DELAYED IGNITION**CAUSE**

1. Pilot flame too low.
2. Pilot burner ports or pilot orifice clogged.
3. Burners or orifices out of alignment.
4. Excessive primary air.
5. Excessive burner input.
6. Adverse draft condition in boiler room.

REMEDY

1. Increase gas supply to pilot.
2. Clean ports or orifices.
3. Realign burners or manifold.
4. Adjust primary air shutters.
5. Check and reduce to input shown on rating plate.
6. Check air supply and venting system.

FUMES AND GAS ODORS**CAUSE**

1. Leaks in gas piping or accessories.
2. Gas leaks in service line or meter connections.
3. Blocked chimney.
4. Boiler flueways blocked with soot.
5. Undersized breeching or too many turns in breeching.
6. Adverse draft condition in boiler room.
7. Overfiring.

REMEDY

1. Locate leaks and repair.
2. Close service supply valve—shut down appliance and notify utility.
3. Check and repair chimney.
4. Clean flueways and adjust burners as described in the installation instructions.
5. Check manufacturer's recommendations.
6. Check air supply and venting system.
7. Adjust gas input to that shown on boiler rating plate.

CONDENSATION IN BOILER FLUES OR IN VENT SYSTEM**CAUSE**

1. Underfiring.
2. Boiler water maintained at too low a temperature level.
3. Long horizontal run of smokepipe.
4. Inadequate chimney or venting system.

REMEDY

1. Increase firing rate to that shown on rating plate.
2. Set low limit controls to maintain a higher water temperature. If boiler is not equipped with low limit replace with one which has a combination low limit/high limit aquastat.
3. Relocate boiler or insulate breeching.
4. Check chimney and venting recommendations.

IF REPLACEMENT PARTS ARE NEEDED

When parts are needed, refer to boiler model and serial number shown on the boiler name/rating plate. Whenever possible refer to the original order by number and date.

Control identification and replacement should not be attempted by unskilled personnel. Only simple, easily-identified controls

and parts maybe obtained locally. All other controls and parts should be identified by and ordered from Slant/Fin. Relief/Safety valves must be ASME rated for the pressure and gross output of the boiler.

For replacement parts, heating contractors should contact their Slant/Fin boiler distributor.

APPENDIX A**Removal of Existing Boiler from Common Vent System**

"At the time of removal of an existing boiler, the following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation."

- (a) Seal any unused openings in the common venting system.
- (b) Visually inspect the venting system for proper size and horizontal pitch and determine there is no blockage or restriction, leakage, corrosion and other deficiencies which could cause an unsafe condition.
- (c) Insofar as is practical, close all building doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building. Turn on clothes dryer and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. DO NOT operate a summer exhaust fan. Close fireplace dampers.
- (d) Place in operation the appliance being inspected. Follow the lighting instructions. Adjust thermostat so appliance will operate continuously.
- (e) Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle, or smoke from a cigarette, cigar or pipe.
- (f) After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous conditions of use.
- (g) Any improper operation of the common venting system should be corrected so the installation conforms with the National Fuel Gas Code, ANSI Z2231 latest edition or CSA B 149.1 latest edition for natural gas and propane. When resizing any portion of the common venting system, the common venting system should be resized to approach the minimum size as determined using the appropriate tables in Appendix G in the National Fuel Gas Code, ANSI Z2231 latest edition or CSA B 149.1 latest edition for natural gas and propane.

APPENDIX B**Thermostatic Bypass Valve**

Thermostatic bypass valves type TV are designed to allow boilers to reach their optimum operating temperature quickly and to prevent cool/cold return temperatures from affecting them.

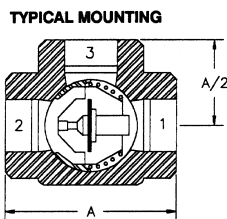
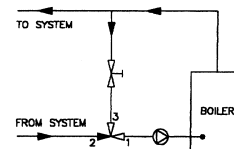
Operation/Installation: The thermostat within the "TV" valve allows full flow through the bypass until the predetermined temperature is reached.

Start Up: With the balancing valve on the bypass fully open, operate the boiler until it reaches its normal operating temperature. If hot water does not automatically flow to the system then adjust (throttle) the bypass balancing valve until flow (hot water) to the system is established. If flow is already to the system, no adjustment is required.

Return Mounting: On the return "TV" allows full bypass until the return temperature reaches 46 degrees Celsius (115 degrees

Fahrenheit). "TV" will begin opening while maintaining a 46 degrees Celsius (115 degrees Fahrenheit) minimum return temperature. When return temperatures reach approximately 54 degrees Celsius (130 degrees Fahrenheit) most of the flow will be through the system.

Mounting: "TV" can be installed in any position. An adjustable balancing valve (or ball valve) must be installed on the bypass.

**TYPICAL RETURN VALVE MOUNTING**

| SIZE | S/F PART NO. | OPEN TEMP. | A | A/2 | Kv | Cv | WEIGHT |
|------------------------------|--------------|--------------|-------------|-------------|-------|------|---------------|
| 1" NPT (female x female) | 116040 | 46 °C 115 °F | 107 mm 4.2" | 53 mm 2.1" | 8.96 | 10.5 | 1.5 kg 3.3 lb |
| 1 1/4" NPT (female x female) | 116041 | 46 °C 115 °F | 114 mm 4.5" | 57 mm 2.25" | 13.99 | 16.4 | 2.0 kg 4.4 lb |
| 1 1/2" NPT (female x female) | 116042 | 46 °C 115 °F | 119 mm 4.7" | 60 mm 2.35" | 17.23 | 20.2 | 2.4 kg 5.3 lb |

Max. operating pressure 6 bar (85 psi) Maximum operating temperature 110°C (230°F)

The flow factor Kv is the number of cubic meters per hour of water at 20°C which will flow through the valve with a pressure drop of 1kg/cm² (1 bar).

The flow coefficient Cv is the flow of water at 60°F in US gallons per minute at a pressure drop of 1lb/in² across the valve.

APPENDIX C

Thermostat Heat Anticipator Settings

Fixed anticipator thermostats are not adjustable.

Adjustable anticipator thermostats, depending on thermostat model, may be adjustable from a .18 to a .9 setting by moving a pointer on the anticipator.

The higher the anticipator setting (towards .9) the longer it will take for the thermostat to respond to a change in room temperature. Too high a setting and the boiler will be slow to respond to a temperature change in the room. This can cause the room temperature to drop to an uncomfortable level before the boiler starts. This may generate homeowner complaints.

The lower the anticipator setting (toward .18) the faster the thermostat will respond to a change in room temperature. Too low a setting and the boiler will short cycle. Boiler short cycling will cause unnecessary wear on the equipment and in the case of oil boilers it can lead to poor combustion and more frequent cleaning of the combustion area.

It is important to understand what the thermostat is controlling and then determine the amp rating of that relay, gas valve, zone valve or control. This information is usually stamped somewhere on the component. A properly set anticipator will allow the system to operate at its maximum effectiveness.

APPENDIX D

Accumulation of Foreign Deposits in Heat Exchanger

Recent investigations of boilers which were installed in hard water areas, revealed that mineral deposits had accumulated at the bottom of the heat exchanger. In addition, sludge, scale and other solid contaminants were present in boilers installed in older systems or where the water was supplied from a well. This accumulation creates an insulating layer that drastically affects boiler efficiency by reducing the transmission of heat through this primary transfer surface and causes extreme metal temperatures that eventually crack the heat exchanger.

RECOMMENDATIONS:

On all installations in hard water areas:

1. The system should be thoroughly inspected for leaks which must be repaired however minor they may be.
2. The initial water charge of the system must be treated to reduce its hardness to an acceptable level.

In addition to the aforementioned, older systems and those supplied from wells may require that a filter or strainer be incorporated in the circuit at some point on the return line closest to the boiler. Suitable water treatment filters are commercially available for this purpose.

THE TERMS OF THE BOILER WARRANTY WILL NOT APPLY TO FAILURES ENCOUNTERED UNDER THESE CIRCUMSTANCES.

WE STRONGLY RECOMMEND THAT YOU CONVEY THIS VITAL INFORMATION TO ALL PARTIES CONCERNED.

APPENDIX E

Use of non-oxygen diffusion barrier underfloor tubing

The boiler warranty does not cover leaks resulting from corrosion caused by the use of underfloor plastic tubing without an oxygen diffusion barrier. Systems must have the non-oxygen diffusion barrier tubing separated from the

boiler with a heat exchanger, Slant/Fin recommends the use of underfloor plastic tubing with an oxygen diffusion barrier. Other system components may also require protection from oxygen permeation.